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[RECORD OF SUBMITTED ITEMS]

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[Document] Specification

[Title of the Invention] LASER BEAM SCANNER

[Scope of the Claims]

[Claim 1]

A laser beam scanner, comprising:

a laser light source;

first collecting means that collects a laser beam emitted from the laser light source;

deflecting scanning means that deflectingly scans the laser beam collected by the first collecting means;

second collecting means that is arranged between the deflecting scanning means and the photosensitive body and is provided with power mainly in a main scanning direction;

third collecting means that is arranged between the second collecting means and the photosensitive body and is provided with power mainly in a sub scanning direction; and

detecting means that detects a scanning start timing of the laser beam by detecting the laser beam deflectingly scanned by the deflecting scanning means, the laser beam scanner collecting the laser beams deflectingly scanned by the deflecting scanning means to the photosensitive body via the second and third collecting means,

wherein the first collecting means collects the laser beam emitted from the laser light source in a sub scanning direction onto the deflecting scanning means by using a single directionality collecting lens; and

the detecting means collects the laser beam that is emitted from the second collecting means and does not enter the third collecting means in a sub scanning direction, using the same

single directionality collecting lens as the single directionality collecting lens provided on the first collecting means, and detects the collected laser beam.

[Claim 2]

The laser beam scanner as set forth in claim 1,

wherein the single directionality collecting lens provided at the first collecting means is used as the single directionality collecting lens provided at the second collecting means, and the single directionality collecting lens provided at the second collecting means is used as the single directionality collecting lens provided at the first collecting means.

[Claim 3]

The laser beam scanner as set forth in claim 1 or 2,

wherein when the distance between objects in a sub scanning direction of the single directionality collecting lens is L and the focal length is fcy, if $L < 4fcy$, the single directionality collecting lens is arranged so that the height of the laser beam in a sub scanning direction is within a detecting range in a sub scanning direction of the detecting means.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

This invention relates to a laser beam scanner that exposes an image by scanning a laser beam onto a photosensitive body.

[0002]

[Prior Art]

Conventionally, as this type of laser beam scanner, for example, a scanner shown in Fig. 8 is known. Fig. 8 is an explanatory view showing a main structure of a conventional laser beam scanner.

A laser beam scanner 100 is provided with a laser light source 101 integrated with a semiconductor laser element and a collimating lens, a cylinder lens 102 that collects a laser beam emitted from the laser light source 101, a polygon mirror 103 that deflects the laser beam that has gone through the cylinder lens 102, a first fθ lens 104 and a second fθ lens 105 that collect the laser beam deflected by the polygon mirror 103 onto a photosensitive drum 110, a light detecting element 106 that detects the laser beam that has gone through the second fθ lens 105, and a BD imaging lens 107 that collects the laser beam that has gone through the second fθ lens 105 to the BD sensor 106.

The first fθ lens 104 is provided with power mainly in a main scanning direction, and the second fθ lens 105 is provided with power mainly in a sub scanning direction. The BD sensor 106 detects a scanning start timing of the laser beam emitted from the semiconductor laser element 101 and is arranged within a range outside of an effective scanning region in the photosensitive drum 110 and in a position at which the laser beam is collected.

Furthermore, a laser beam scanner is also known in which the laser beam that has gone through the second fθ lens 105 is reflected by a mirror, and the reflected light is collected at the BD sensor 106 by being caused to pass through the BD imaging lens 107 .

[0003]

[Problems to be Resolved by the Invention]

Meanwhile, further miniaturization of a laser printer, a digital copier, etc. using a laser beam scanner is required. In particular, it is a challenge to reduce the space near the second fθ lens, which has a width in a main scanning direction, and the photosensitive drum.

However, in each of the above-mentioned conventional laser beam scanners 100, the laser beam that has gone through the fθ lens 105 is collected at the BD sensor 106. The BD imaging lens 107, the BD sensor 106, etc. are arranged in the vicinity of the second f θ lens and the photosensitive drum, so it is difficult to resolve the above-mentioned problem.

Additionally, the above-mentioned respective conventional laser beam scanners 100 use different types of lenses such as the cylinder lens 102, the BD imaging lens 107, etc. in order to collect the laser beam. There are no parts in common, so there is another problem with a high manufacturing cost.

[0004]

Therefore, this invention reflects on the above-mentioned problem. An object of this invention is to provide a laser beam scanner that can achieve space reduction in the vicinity of an fθ lens having a power in a sub scanning direction and a photosensitive body, and that can reduce a manufacturing cost.

[0005]

[Means of Solving the Problem, Effect and Operation of the Invention]

In order to accomplish the above-mentioned object, in the invention described in claims 1 - 3, this invention uses technical means in which a laser beam scanner is provided with a laser light source; first collecting means that collects a laser beam emitted from the laser light source; deflecting scanning means that deflectingly scans the laser beam collected by the first collecting means; second collecting means that is arranged between the deflecting scanning means and the

photosensitive body and is provided with power mainly in a main scanning direction; third collecting means that is arranged between the second collecting means and the photosensitive body and is provided with power mainly in a sub scanning direction; and detecting means that detects a scanning start timing of the laser beam by detecting the laser beam deflectingly scanned by the deflecting scanning means, the laser beam scanner collecting the laser beams deflectingly scanned by the deflecting scanning means to the photosensitive body via the second and third collecting means, wherein the first collecting means collects the laser beam emitted from the laser light source in a sub scanning direction onto the deflecting scanning means by using a single directionality collecting lens; and the detecting means collects the laser beam that is emitted from the second collecting means and does not enter the third collecting means in a sub scanning direction, using the same single directionality collecting lens as the single directionality collecting lens provided on the first collecting means, and detects the collected laser beam.

[0006]

The detecting means collects the laser beam that is emitted from the second collecting means and does not enter the third collecting means in a sub scanning direction, using the single directionality collecting lens as the single directionality collecting lens provided with the first collecting means and detects the collected laser beam.

That is, the detecting means does not detect the laser beam emitted from the third collecting means, but detects the laser beam emitted from the second collecting means. Thus, detecting means does not need to be arranged in the vicinity of the third collecting means (for example, an fθ lens having a power in a sub scanning direction) and a photosensitive body, so a space reduction in the vicinity thereof can be achieved. Furthermore, the detecting means collects the laser beam in the sub scanning direction, using the same single directionality

collecting lens as the single directionality collecting lens provided with the first collecting means, so the number of parts in common increases, so the manufacturing cost of the laser beam scanner can be reduced.

[0007]

In the invention described in claim 2, in the laser beam scanner described in claim 1, technical means is used in which the single directionality collecting lens provided at the first collecting means is used as the single directionality collecting lens provided at the second collecting means, and the single directionality collecting lens provided at the second collecting means is used as the single directionality collecting lens provided at the first collecting means.

[0008]

That is, the single directionality collecting lens provided with the first collecting means is also used as a single directionality collecting lens provided with detecting means, so the number of the single directionality collecting lenses needed can be reduced.

Therefore, the number of steps of mounting the single directionality collecting lens is reduced. Thus, manufacturing efficiency of the laser beam scanner can be improved, and the manufacturing cost can be reduced.

[0009]

In the invention described in claim 3, in the laser beam scanner described in claim 1 or 2, technical means is used in which when the distance between objects in a sub scanning direction of the single directionality collecting lens is L and the focal length is fcy, if $L < 4fcy$, the single directionality collecting lens is arranged so that the height of the laser beam in a sub scanning direction is within a detecting range in a sub scanning direction of the detecting means.

[0010]

That is, when the distance between the objects in the sub scanning direction of the single directionality collecting lens is L and the focal length is fcy, when $L<4fcy$ is established, by arranging the single directionality collecting lens so that the height of the laser beam in the sub scanning direction is within the detecting range in the sub scanning direction of the detecting means, the height of the beam spot can be made smaller than the light receiving portion provided at the detecting means.

Therefore, even when the beam spots cannot be sufficiently collected in the sub scanning direction, sufficient light can be incident to the detecting means, so detecting accuracy can be improved.

[0011]

[Embodiments]

[First Embodiment]

The following explains a first embodiment of a laser beam scanner related to this invention with reference to the drawings. Furthermore, in the following respective embodiments, a laser beam scanner used for a laser printer as a laser beam scanner related to this invention is used as an example (main structure of a laser printer).

First, the main structure of a laser printer is explained with reference to Fig. 1. Fig. 1 is an explanatory view showing a partial cross section of a laser printer 1 in a perspective view from a direction perpendicular to a paper transfer direction. Additionally, in Fig. 1, the surface shown by arrow X is a front surface, the surface shown by arrow Y is a top surface, and the side closest to the reader is a left side surface.

[0012]

With respect to the laser printer 1, the overall shape is formed in a substantially rectangular parallelepiped shape by a main body frame 11. Under the main body frame 11, a paper feeding portion 19 is arranged, which houses paper by housing paper P and feeds the paper. The paper P is transferred to a transfer portion 18 from the paper feeding portion 19 via the front portion of the device. Above the transfer portion 18, a developer 17 is arranged, which is integrally constituted as a process unit. Furthermore, above the developer 17, a laser beam scanner 12 of this embodiment is arranged. A photosensitive body drum 77 provided with the developer 17 is uniformly charged by a charges 78 arranged above the photosensitive body drum 77. The laser beam scanner 12 forms a latent image by scanning on the photosensitive body drum 77 one or a plurality of laser beams modulated according to an image signal.

[0013]

Meanwhile, toner T housed in the developer 17 is supplied to a developing roller 75 by a supply roller 74. The toner T adhered to the circumferential surface of the developing roller 75 develops a latent image formed in the photosensitive body drum 77, the image is made to be clearly presented, and an image is formed by a toner. Furthermore, the toner T adhered to the circumferential surface of the developing roller 75 is controlled by a layer thickness regulation blade 76 so as to have an appropriate layer thickness. The paper P transferred to the transfer portion 18 is pinched between the photosensitive body drum 77 and the transfer roller 87, so the image on the photosensitive body drum 77 is transferred to the paper P and is transferred to the fixing portion 15 at the rear. Subsequently, the paper P is pinched between a heat roller 52 and a pressure roller 54, so the toner on the paper P is dissolved and permeates fibers of the paper P, and the paper P is transferred to the rear portion. Subsequently, the paper P is discharged to a printed paper mounting portion 69 via a paper discharging portion 16 by a first paper discharging

roller 55, a first follow-up roller 56 that follows the first paper discharging roller 55, and a second follow-up roller 57.

[0014]

(Main Structure of Laser Beam Scanner)

The following explains a main structure of a laser beam scanner 12 with reference to Figs. 2 and 3. Fig. 2 is an explanatory view showing a main structure of the laser beam scanner 12. Fig. 3(A) is an explanatory view showing a main scanning principle of an exposure system of the laser beam scanner 12. Fig. 3(B) is an explanatory view showing a sub scanning principle of an exposure system of the laser beam scanner 12. Fig. 3(C) is an explanatory view showing a main scanning principle of a BD detecting system of the laser beam scanner 12. Fig. 3(D) is an explanatory view showing a sub scanning principle of the BD detecting system of the laser beam scanner 12.

[0015]

The laser beam scanner 12 is provided with a laser light source 47 integrated with a laser diode (shown by 47a of Fig. 3) and a collimated lens (shown by 47b of Fig. 3), a first cylinder lens 13, a polygon mirror 23, a first fθ lens 21, a second fθ lens 22, a mirror 25, a second cylinder lens 14, a member 48 having a slit 48a, and a BD sensor 49. The first and second cylinder lenses 13 and 14 are the same cylinder lenses.

The laser beam LB emitted from the laser light source 47 is collected by the first cylinder lens 13 mainly in a sub scanning direction and projected onto the polygon mirror 23. The polygon mirror 23 is rotated by an undepicted scanner motor at a high speed in a direction shown by the arrow and is deflected so as to conformally move the laser beam LB. This conformally moved laser beam LB is collected by the first fθ lens 21 mainly in a main scanning direction

(Fig. 3(A)), and is collected by the second fθ lens 22 mainly in a sub scanning direction (Fig. 3(B)), and is irradiated so as to be moved on the photosensitive body drum 77 in the main scanning direction so as to form a latent image on the photosensitive body drum 77.

[0016]

The laser beam LB is reflected by the mirror 25 immediately before scanning the photosensitive body drum 77. This reflected laser beam LB does not go through the second fθ lens 22 that has power mainly in the sub scanning direction, so by going through the second cylinder lens 14 that has power mainly in the sub scanning direction, the beam is collected mainly in the sub scanning direction (Fig. 3(D)). The laser beam collected by the second cylinder lens 14 mainly in the sub scanning direction goes through the slit 48a that is formed in the member 48 so as to be extended in the sub scanning direction, and is received by the BD sensor 49.

Furthermore, the photosensitive body drum 77 is rotated so as to be synchronized with the timing of the main scanning by an undepicted stepping motor. As the photosensitive body drum 77 is rotated, the photosensitive body that is formed on the surface of the photosensitive body drum 77 is relatively sub-scanned and sequentially irradiated, and the entire photosensitive body is exposed so as to form a latent image.

[0017]

(Experiment Concerning the Relationship Between the Beam Spot Shape and the Detecting Waveform)

These inventors performed an experiment concerning the relationship between the beam spot shape and the detected waveform. Fig. 4(A) is an explanatory view showing a state in which the laser beam is collected in a sub scanning cross section. Fig. 4(B) is an explanatory

view showing a state in which the laser beam is not completely collected in a sub scanning cross section. Fig. 4(C) is an explanatory view showing the relationship between the beam spot collected in a main scanning direction and a slit.

Fig. 5(A) is an explanatory view showing the relationship between the beam spot collected in the main scanning direction and the sub scanning direction, and the slit. Fig. 5(B) is an explanatory view showing an output waveform of the BD sensor 49 when the beam spot shown in Fig. 5(A) goes through the slit. Fig. 5(C) is an explanatory view of the BD signal.

Fig. 6(A) is an explanatory view showing the relationship between the beam spot not completely collected in the main scanning direction and the sub scanning direction, and the slit. Fig. 6(B) is an explanatory view showing an output waveform of the BD sensor 49 when the beam spot shown in Fig. 6(A) goes through the slit. Fig. 6(C) is an explanatory view of the BD signal.

[0018]

As shown in Fig. 5(A), if the beam spot BS is sufficiently collected in the main scanning direction and the sub scanning direction and passed through the slit 48a, the output waveform of the BD sensor 49 becomes a waveform shown in Fig. 5(B). This waveform is an analog waveform. If a threshold value V1 is set for this, a digital BD signal shown in Fig. 5(C) is obtained. At this point, due to fluctuation, noise, etc., as shown in Fig. 5(B), the threshold value V1 of the analog signal is vertically ΔV-fluctuated. Because of this, as shown in Fig. 5(C), an error $\Delta t1$ is generated in the BD signal in the time axis t direction.

In the same manner, as shown in Fig. 6(A), if the beam spot BS passes through the slit 48a in a state in which the beam spot BS is not completely collected in the main scanning direction and the sub scanning direction, the output waveform of the BD sensor 49 becomes a

more moderately inclined waveform than that of Fig. 5(B). If a threshold value V1 is set for this, the BD signal shown in Fig. 6(C) is obtained. At this point, by the amount that the inclination of the analog waveform is moderate, the fluctuation ΔV of the threshold value V1 is generated as an error $\Delta t2$. Here, $\Delta t1 < \Delta t2$.

[0019]

Additionally, as shown in Fig. 4(C), if a beam spot BS not collected in the sub scanning direction, but collected in the main scanning direction passes through the slit 48a, the same waveform as shown in Figs. 5(B) and (C) was obtained.

That is, it was discovered that in a state in which the beam spot BS is not completely collected in the main scanning direction and the sub scanning direction, sufficient accuracy of the BD signal in the time axis direction cannot be obtained; however, if it is collected in the main scanning direction, sufficient accuracy of the BD signal in the time axis direction can be obtained.

That is, as shown by the laser beam scanner 12 (Fig. 2) related to this embodiment, it was discovered that the beam spot introduced to the BD sensor 49 goes through the first fθ lens 21 that collects the beam spot in the main scanning direction; thus, even if the beam spot does not go through the second fθ lens 22, sufficient accuracy of the BD signal in the time axis direction can be obtained by the BD sensor 49.

Furthermore, in the laser beam scanner 12 related to this embodiment, the second cylinder lens 14 is arranged so that the beam spot that has gone through the first fθ lens 21 is made to be a size within a light receiving range of the BD sensor 49, and the beam spot is collected in the sub scanning direction.

[0020]

(Arranging Position of the Second Cylinder Lens 14)

Next, these inventors studied the situation in order to obtain a preferable arranging position of the second cylinder lens 14. In the following description, the distance between objects (the distance between the polygon mirror 23 and the BD sensor 49) of the second cylinder lens 14 in the sub scanning direction is defined as L, and the focal length is defined as fcy. Additionally, the distance between the polygon mirror 23 and the center of the second cylinder lens 14 is defined as L1, and the distance between the second cylinder lens 14 and the BD sensor 49 is defined as L2.

[0021]

As shown in Fig. 4(A), when the beam spot is collected in the BD sensor 49, the following imaging equation is established.

[0022]

$(1/fcy) = (1/L1) + (1/L2)$ ...First equation

[0023]

The symbols of L1, L2 are positive. According to the first equation, if the distance L (=L1+L2) between the objects, which is the distance over which the beam spot is collected in the main scanning direction, is a minimum value, then L1=L2=2fcy. That is, if the condition of $L \geqq$ fcy is established, it is possible to arrange an optical member so that the beam spot is collected in both the main scanning direction and the sub scanning direction.

Additionally, if there is a condition in which the focal length fcy of the second cylinder lens 14 and the distance L between the objects are below the minimum value, that is, in the case of L<4fcy, as shown in Fig. 4(B), the beam cannot be completely imaged in the sub scanning direction. In Fig. 4(B), if the heights from the optical axis to the outermost side of the beam

when the beam goes through the second cylinder lens 14 and the BD sensor 49 are h1, h2, respectively, the following second through fifth equations can be established.

[0024]

$h2 = h1 - L2u2$ ... Second equation

$u2 = (h1/fcy) - u1$ ... Third equation

$u1 = h1/L1$ ... Fourth equation

$L = L1+L2$ ... Fifth equation

[0025]

According to the above-mentioned second through fifth equations, the following sixth equation can be established.

[0026]

$h2 = L1u1 - L2\ ((L1u1/fcy) - u1) = (u1/fcy)\ (Lfcy - LL1 + L1^2)$ ... Sixth equation

[0027]

According to the sixth equation, the height of the beam spot that enters the BD sensor 49 in the sub scanning direction can be obtained. Here, as shown in Fig. 4(C), if the height of the light receiving portion (slit 48a) of the BD sensor 49 is H, the following seventh equation can be obtained.

[0028]

$H \geqq 2h2$ ... Seventh equation

That is, it was discovered that it is desirable that the second cylinder lens 14 is arranged so that the height of the beam spot in the sub scanning direction is within a detecting range of the light receiving portion of the BD sensor 49 in the sub scanning direction.

[0029]

Thus, if the laser beam scanner 12 of the first embodiment is used, the scanning start timing can be detected with high accuracy by using a laser beam that goes through the first fθ lens 21 and does not go through the second fθ lens 22. Therefore, without arranging the BD sensor 49 in the vicinity of the photosensitive body drum 77 and the second fθ lens 22, a smaller space in the vicinity thereof can be achieved. Furthermore, the respective first and second cylinder lenses 13 and 14 can use the same cylinder lens, so the number of parts in common is increased; thus, the manufacturing cost of the laser beam scanner 12 can be reduced.

[0030]

Furthermore, according to the sixth equation, h2 = 0, that is, a condition in which the light can be imaged at one point can be established. If a quadratic equation is used for the right side of the fifth equation regarding L2, from the relationship between the solution and the coefficient, the condition that can obtain the solution is shown by the following eighth equation.

[0031]

$(-L)^2 - 4fcyL \geqq 0$ ... Eighth equation

[0032]

$L \geqq 4fcy$ ... Ninth equation

[0033]

If the above-mentioned equations are satisfied, the beam can be imaged into one point. If the beam cannot be imaged into one point, and the beam spot is distributed in the sub scanning direction, that is, in the case of L < 4fcy, for the condition at which h2 becomes minimum, as shown in the following tenth equation, the minimum value can be obtained by differentiating the sixth equation with L1.

[0034]

$(dh2/dL1) = (u1/fcy)(-L + 2L1)$ ... Tenth equation

[0035]

If L1 is obtained according to the tenth equation, the following can be established.

[0036]

$L1 = L/2$ ... Eleventh equation

[0037]

Therefore, if the condition of the eleventh equation is satisfied, h2 becomes a minimum value. That is, if the beam spot is not sufficiently collected in the sub scanning direction on the BD optical path, it is desirable that the second cylinder lens 14 is arranged in a position in which the eleventh equation is satisfied.

However, if the condition of the seventh equation is satisfied, the condition of the eleventh equation does not need to be satisfied.

[0038]

[Second Embodiment]

The following explains a second embodiment of a laser beam scanner of this invention with reference to Fig. 7. Fig. 7 is an explanatory view showing a main structure of a laser beam scanner of the second embodiment.

The laser beam scanner related to the second embodiment has a characteristic in which the first cylinder lens is used also as the second cylinder lens. Furthermore, the description of the structure that is the same as in the first embodiment is omitted here. However, the position of the BD sensor moves in an opposite direction, so the rotation direction of the polygon mirror is different.

[0039]

The laser beam LB emitted from the laser light source 47 is collected in the polygon mirror 23 by the first cylinder lens 13, and the laser beam LB deflected in the polygon mirror 23 is collected in the main scanning direction by the first fθ lens 21. The laser beam LB that has gone through the first fθ lens 21 is reflected in the direction of the first cylinder lens 13 by the mirror 25, and the reflected laser beam LB is collected in the BD sensor 49 by the first cylinder lens 13.

Thus, if the laser beam scanner 12 of the second embodiment is used, the first cylinder lens is used as a second cylinder lens, so the second cylinder lens 14 (Fig. 2) is not needed. Therefore, the process of arranging the second cylinder lens 14 is not needed, and the manufacturing efficiency of the laser beam scanner 12 can be improved. Additionally, the manufacturing cost can be reduced because the second cylinder lens 14 is needed.

[0040]

[Other Embodiments]

In the above-mentioned respective embodiments, a cylinder lens is used as an example of a single directionality collecting lens related to this invention. However, as long as a characteristic is provided in which the laser beam can be collected in a single direction, either other lens or the combination of lenses also can be used.

Furthermore, a laser beam scanner used in a laser printer as a laser beam scanner related to this invention is used as an example. Of course, the laser beam scanner of this invention can be used for a copy machine, a printer provided with a facsimile machine, etc.

[0041]

[Corresponding Relationships of the Respective Lens and Embodiments]

The first cylinder lens 13 corresponds to a first collecting means related to claim 1, and the polygon mirror 23 corresponds to a deflecting scanning means. Furthermore, the first fθ lens 21 corresponds to a second collecting means, and a second fθ lens 22 corresponds to a third collecting means. Additionally, the BD sensor 49 corresponds to a detecting means, and a second cylinder lens 14 corresponds to a single directionality collecting lens.

[Brief Description of the Drawings]

Fig. 1 is an explanatory view showing a partial cross section in which a laser printer 1 is viewed from a direction perpendicular to a paper transfer direction.

Fig. 2 is an explanatory view showing a main structure of a laser beam scanner 12.

Fig. 3(A) is an explanatory view showing a main scanning principle in an exposure system of the laser beam scanner 12. Fig. 3(B) is an explanatory view showing a sub scanning principle in an exposure system of the laser beam scanner 12. Fig. 3(C) is an explanatory view showing the main scanning principle and a BD detecting system of the laser beam scanner 12. Fig. 3(D) is an explanatory view showing the sub scanning principle in a BD detecting system of a laser beam scanner 12.

Fig. 4(A) is an explanatory view showing a state in which a laser beam is collected in a sub scanning cross section. Fig. 4(B) is an explanatory view showing a state in which a laser beam is not completely collected in a sub scanning cross-section. Fig. 4(C) is an explanatory view showing the relationship between a slit and a beam spot collected in a main scanning direction.

Fig. 5(A) is an explanatory view showing the relationship between the slit and the beam spot collected in a main scanning direction and a sub scanning direction. Fig. 5(B) is an

explanatory view showing an output waveform of the BD sensor 49 when the beam spot shown in Fig. 5(A) goes through the slit. Fig. 5(C) is an explanatory view of the BD signal.

Fig. 6(A) is an explanatory view showing the relationship between the slit and the beam spot that is not completely collected in the main scanning direction and the sub scanning direction. Fig. 6(B) is an explanatory view showing an output waveform of the BD sensor 49 when the beam spot shown in Fig. 6(A) goes through the slit. Fig. 6 is an explanatory view of the BD signal.

Fig. 7 is an explanatory view showing a main structure of the laser beam scanner of the second embodiment of this invention.

Fig. 8 is an explanatory view showing a main structure of a conventional laser beam scanner.

[Explanation of the Symbols]

1	Laser printer
12	Laser beam scanner
13	First cylinder lens (first collecting means)
14	Second cylinder lens
21	First fθ lens (second collecting means)
22	Second fθ lens (third collecting means)
23	Polygon mirror (deflecting scanning means)
25	Mirror
47	Laser light source
49	BD sensor (detecting means)
LB	Laser beam

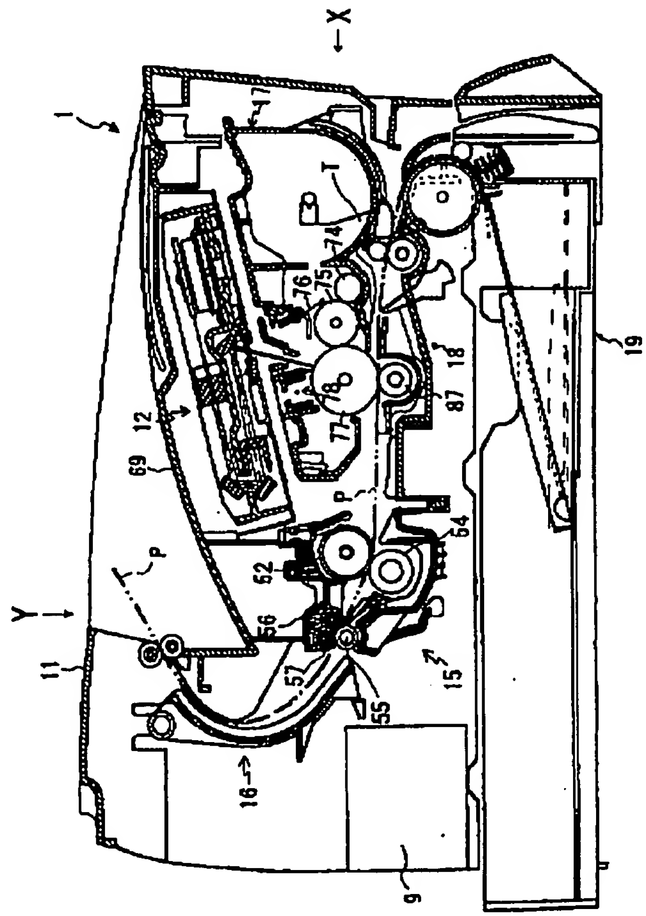
[Document] Abstract

[Abstract]

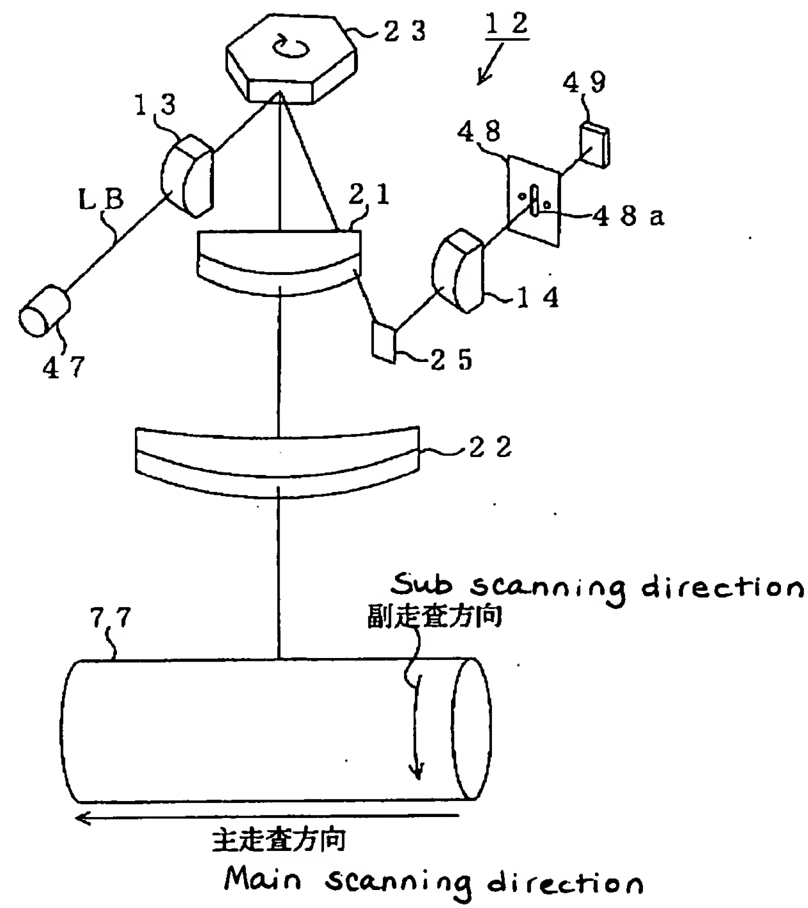
[Problem] To realize a laser beam scanner that can achieve a space reduction in the vicinity of a photosensitive body and an fθ having power mainly in a sub scanning direction, and that can reduce a manufacturing cost.

[Solving Means] A laser beam LB that goes through a first fθ lens 21 having power mainly in a main scanning direction and does not go through a second fθ lens 22 having power in a sub scanning direction is reflected by a mirror 25, and the reflected light is collected in a sub scanning direction by a second cylinder lens 14 used also as a first cylinder lens 13 and is guided to a BD sensor 49. The BD signal based on a detecting signal of the BD sensor 49 requires accuracy in a time axis direction, but by going through the first fθ lens 21, the laser beam LB is collected in the main scanning direction, so accuracy of the BD signal in the time axis direction can be improved.

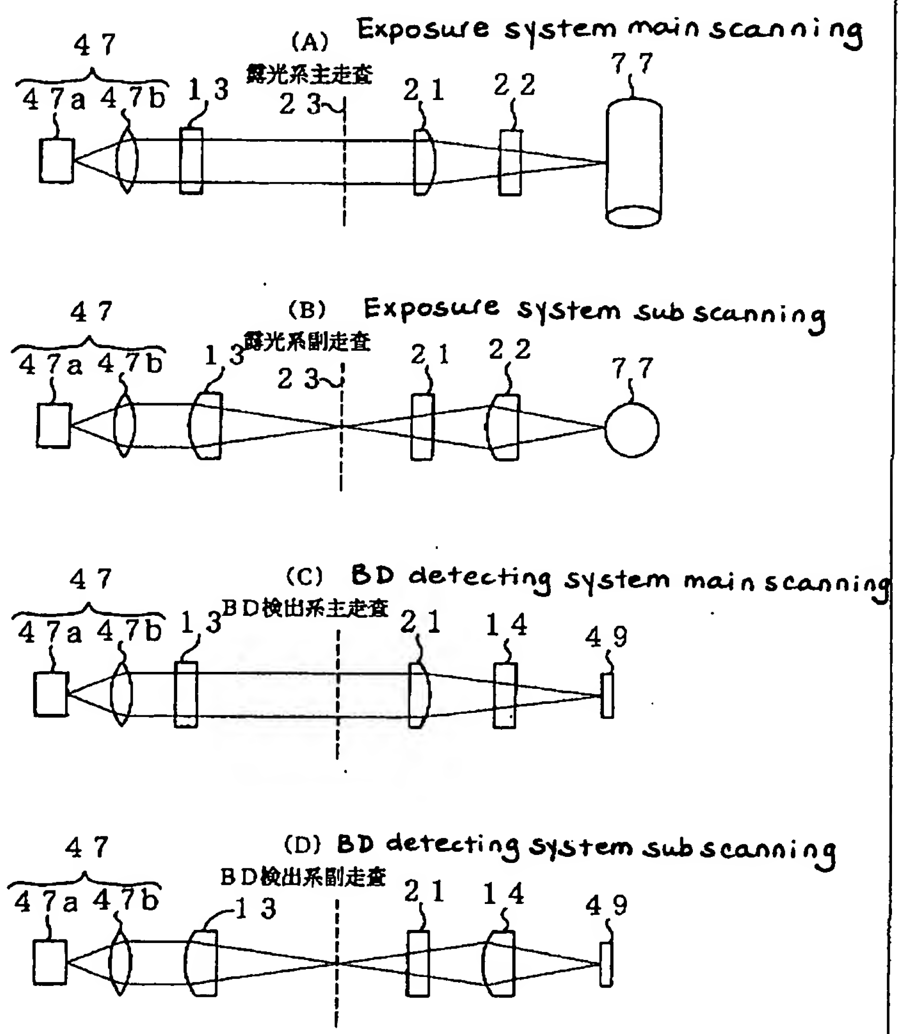
[Selected Figure] Fig. 2


1
11
12
69
19
18
87
64
15
9
55
57
56
52
16
17
74
75
76
77
78
T
p
X
Y

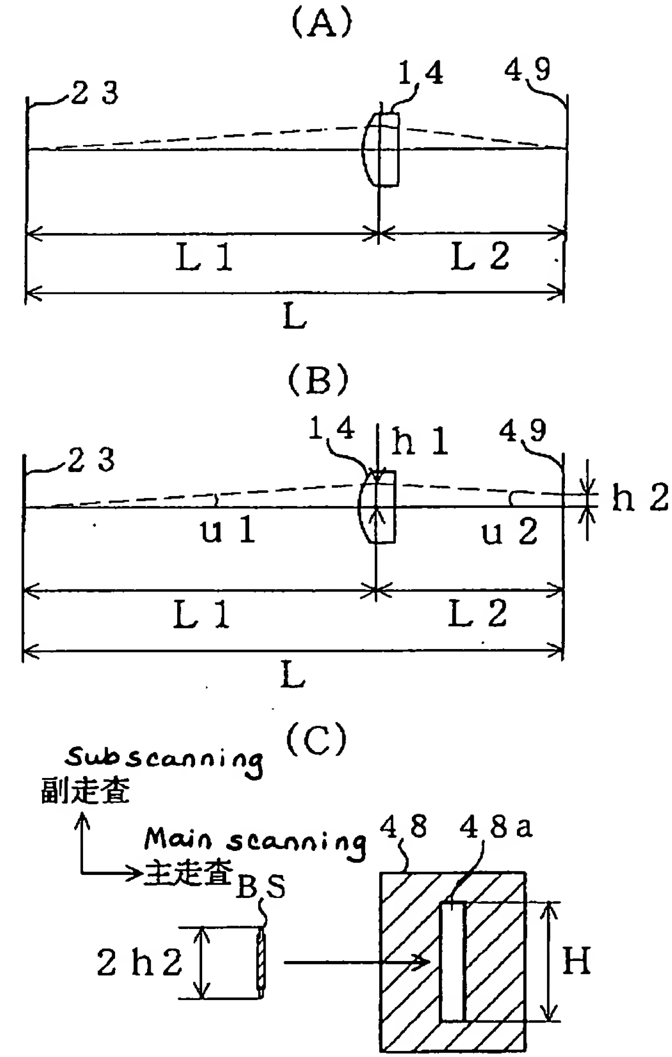
【図2】


23
12
13
49
48
LB
21
48a
14
47
25
22
Sub scanning direction
副走査方向
77
主走査方向
Main scanning direction

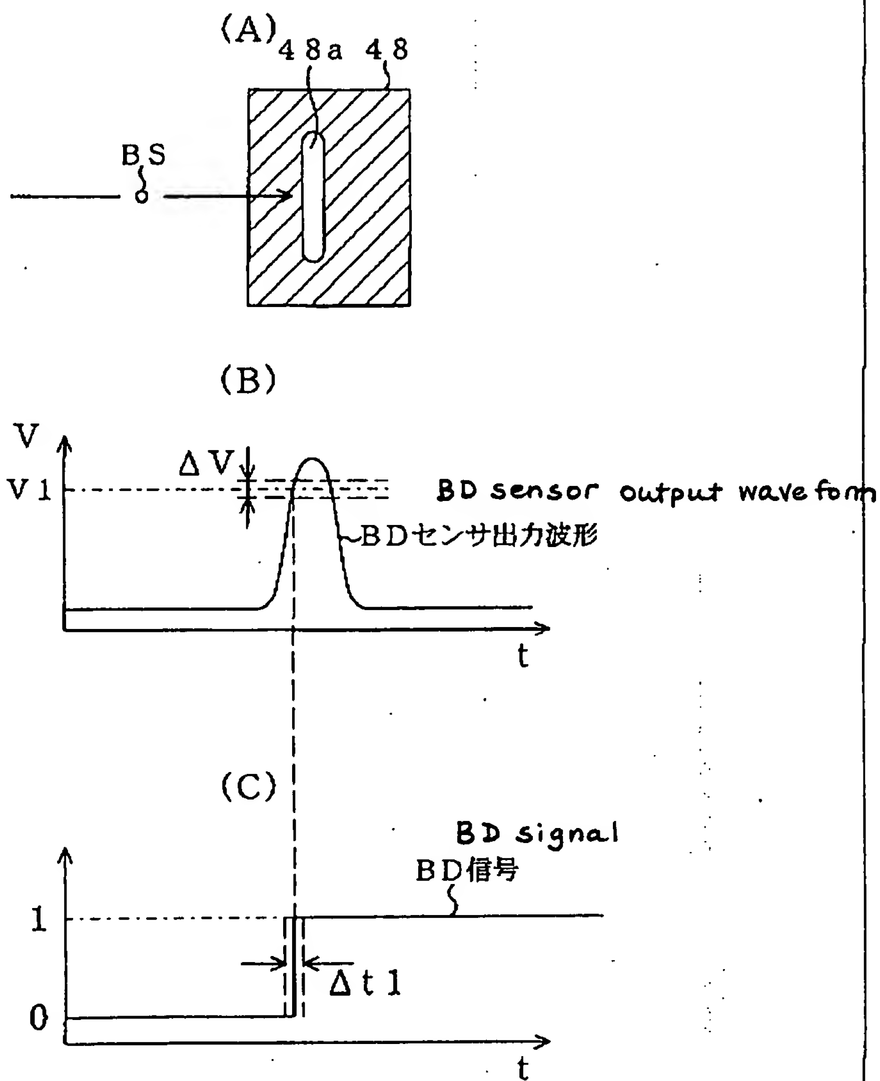
【図3】


(A) Exposure system main scanning
露光系主走査
(B) Exposure system sub scanning
露光系副走査
(C) BD detecting system main scanning
BD検出系主走査
(D) BD detecting system sub scanning
BD検出系副走査
47
47a
47b
13
23
21
22
77
14
49

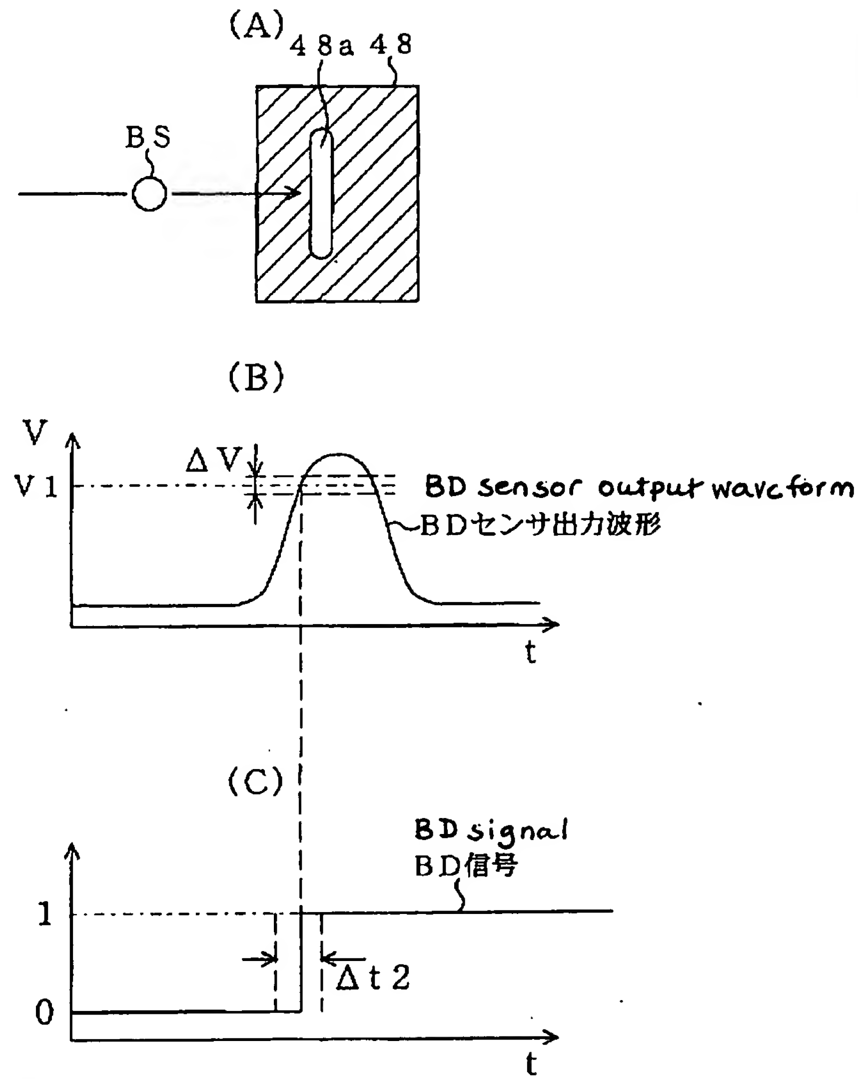
【図4】


(A)
23
14
49
L1
L2
L
(B)
h1
h2
u1
u2
(C)
Sub scanning
副走査
Main scanning
主走査
BS
2h2
48
48a
H

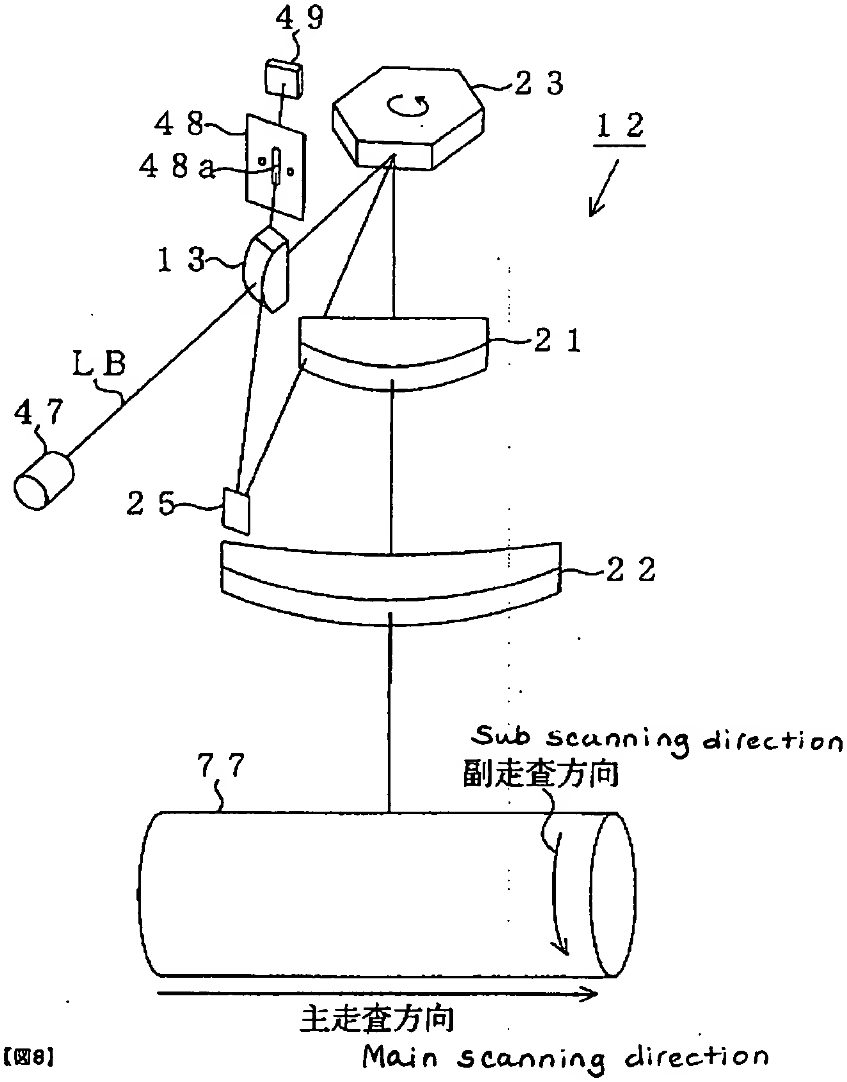
【図5】


(A)
48a
48
BS
(B)
V
V1
ΔV
BD sensor output wave form
BDセンサ出力波形
t
(C)
BD signal
BD信号
1
0
Δt1
t

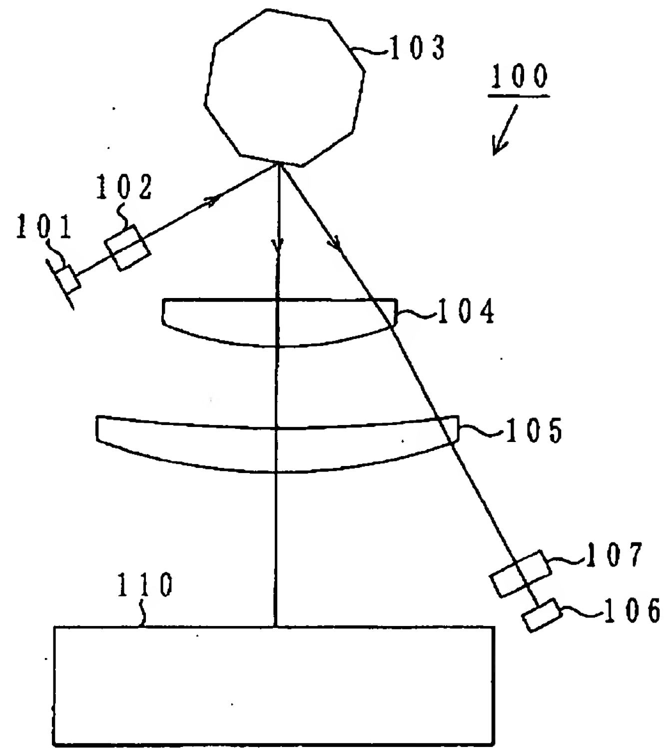
【図6】


(A)
48a
48
BS
(B)
V
V1
ΔV
BD sensor output wavcform
BDセンサ出力波形
t
(C)
BD signal
BD信号
1
0
Δt2
t

【図7】



【図8】



【書類名】　要約書
【要約】
【課題】主として副走査方向にパワーを有するfθレンズおよび感光体の周辺の省スペース化を図ることができるとともに、製造コストを低減できるレーザビームスキャナを実現する。
【解決手段】主として主走査方向にパワーを有する第1fθレンズ21を通過し、主として副走査方向にパワーを有する第2fθレンズ22を通過しないレーザビームLBをミラー25で反射し、その反射